

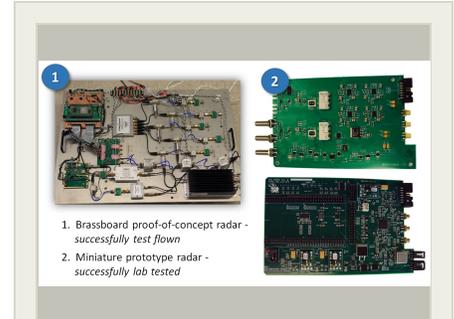
# Collision-avoidance radar for small UAS, Phase I



Completed Technology Project (2015 - 2015)

## Project Introduction

In the near future unmanned aircraft systems (UAS) will be utilized for many societal and commercial applications. However, the hurdle of operation safety in the form of avoiding airborne collisions must first be overcome. Radar is ideally suited for this purpose due to their all weather capability to provide accurate position and velocity data. UAVradars LLC is proposing a small, lightweight, and low-power radar system designed specifically to give small UAS (UAS < 50 lbs) airborne situation awareness capability. The proposed radar is based on previous R&D funded by NASA LEARN at the University of Kansas from 2012 – 2014. This effort resulted in a brassboard proof-of-concept radar system that was successfully flight tested onboard a Cessna 172. The brassboard system was then miniaturized demonstrating the feasibility of reducing its size, weight and power consumption. The proposed SBIR objectives focus on three technical objectives needed to commercialize this radar. Objective 1 is to develop a FPGA controller/processor that can replace the user laptop allowing UAS flight testing in phase II. Objective 2 is to move the radar operation to the ISM band to avoid FCC complications (supporting NASA's goal to simplify certification needs) and to adaptively allocate the radar operating frequency to maximize detection performance. Objective 3 is to encode each radar's transmit with a random phase allowing multiple radar carrying UASs to operate within the same area without cross-jamming one another. By performing these tasks, the resulting phase I radar system will meet NASA's need for UAS technology that would allow humans to safely operate multiple UAS with minimal oversight, and provide the foundation for UAS external perception/cognition and multi-vehicle cooperation. Phase I will result in simulation, hardware in the loop testing, and analysis of all three objectives leveraging the existing prototype miniature radar system.



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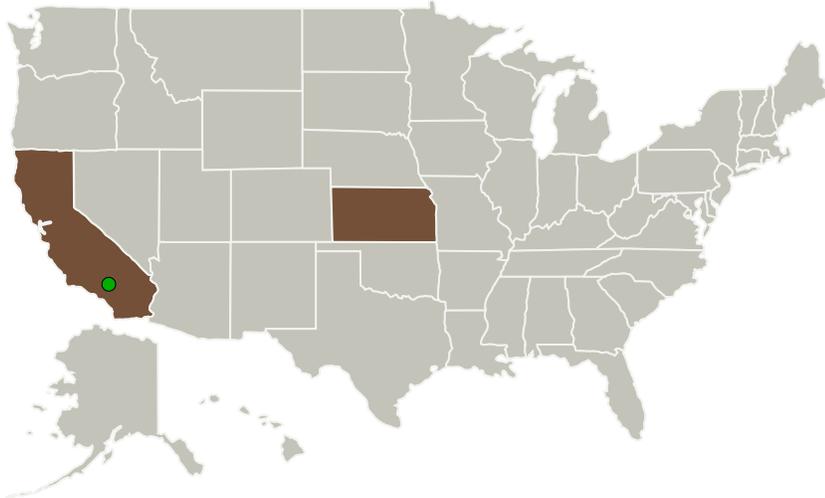
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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
UAVradars, LLC	Lead Organization	Industry Minority-Owned Business	Lawrence, Kansas
● Armstrong Flight Research Center(AFRC)	Supporting Organization	NASA Center	Edwards, California

Primary U.S. Work Locations	
California	Kansas

## Project Transitions

**June 2015:** Project Start

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Organization:**

UAVradars, LLC

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

**Principal Investigator:**

Shi Lei

**Co-Investigator:**

Lei Shi

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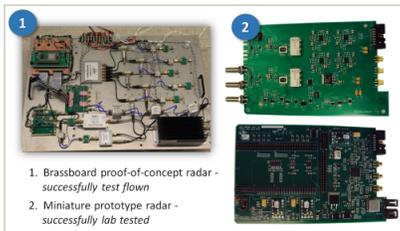
**December 2015:** Closed out

**Closeout Summary:** Collision-avoidance radar for small UAS, Phase I Project I image

**Closeout Documentation:**

- Final Summary Chart Image(<https://techport.nasa.gov/file/138748>)

## Images

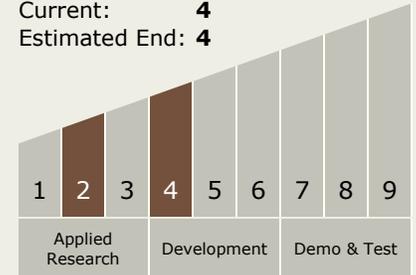


### Briefing Chart Image

Collision-avoidance radar for small UAS, Phase I  
(<https://techport.nasa.gov/image/126278>)

## Technology Maturity (TRL)

Start: 2  
Current: 4  
Estimated End: 4



## Technology Areas

**Primary:**

- TX10 Autonomous Systems
  - └ TX10.1 Situational and Self Awareness
    - └ TX10.1.1 Sensing and Perception for Autonomous Systems

## Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System